We claim:

1. A method for determining areas of structures from an image, the method comprising:

acquiring a digital image;

enhancing the digital image using non-linear filters;

segmenting the digital image using a spatial gradient algorithm, a initial point positioning algorithm, and an optimal path algorithm that combines the spatial gradient and the initial point positioning algorithms to produce homogeneous regions; and

determining the areas of the homogenous regions.

2. The method of Claim 1, wherein the non-linear filters include a heat filter and a shock filter, the heat filter applied to the digital image followed by application of the shock filter to the digital image.

3. The method of Claim 2, wherein the heat filter is defined by a partial differential equation of an inputted image pixel intensity u expressed in an equation defined as

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2},$$

where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u along the x-axis, and $\frac{\partial^2 u}{\partial y^2}$ is the second partial derivative of u along the y-axis.

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4. The method of Claim 2, wherein the shock filter is a partial differential equation of an imputed image pixel intensity u expressed in an equation defined as

$$\frac{\partial u}{\partial t} = -sign(\frac{\partial^2 u}{dx^2})\left|\frac{\partial u}{dx}\right|,$$

where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u, $\left|\frac{\partial u}{dx}\right|$ is the absolute value of the first derivative of u along the x-axis.

5. The method of Claim 1, wherein the optimum path algorithm includes a total cost function $C(p)$ weighted between an edge distance cost function, a path direction cost function, and a previous contour distance cost function from the equation

$$C(p) = \alpha C_e(p) + \beta C_d(p) + \gamma C_c(p),$$

where $C_e(p)$ is the edge distance cost function, $C_d(p)$ is the path direction cost function, $C_c(p)$ is the previous contour distance cost function, and $\alpha, \beta, and \gamma$ are numerical values.

6. The method of Claim 5, wherein the edge distance function $C_e(p)$ is defined from the equation

$$C_e(p) = \sum_{i=p1}^{p2}(\frac{1}{\mu + \|\nabla I_i\|}),$$

where I_i is the pixel intensity, $\|\nabla I_i\|$ is the gradient magnitude the pixel at location i, and μ is a constant value.

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7. The method of Claim 5, wherein the path direction cost function $C_d(p)$ is defined from the equation

$$C_d(p)=\sum_{i=p1}^{p2}(I_i^{in}-I_i^{out}),$$

where I_i^{in} is the image intensity of the inside and dark pixel and I_i^{out} is the image intensities the outside and bright pixel along a path bisecting the I_i^{in} and I_i^{out} pixels and connecting pixels points i and i_{-1} adjacent to each side of the I_i^{in} pixel.

8. The method of Claim 5, wherein the previous contour function $C_c(p)$ is defined by the equation

$$C_c(p)=\sum_{i=p1}^{p2}D_i^P,$$

where P is the previous contour and D_i^P is the distance of point i from the closest point on the previous contour.

9. A method for determining volumes of structures from a set of images, the method comprising:

acquiring at least two digital images;

enhancing each digital image using non-linear filters;

segmenting the digital image using a spatial gradient algorithm, a initial point positioning algorithm, and an optimal path algorithm that combines the spatial gradient and the initial point positioning algorithmto produce homogeneous regions;

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assembling the digital images into an array;

determining the areas of and the volumes between the homogeneous regions in the array.

10. The method of claim 9, wherein the array includes a rotational assembly, a wedge assembly, and a translational assembly.

11. The method of Claim 9, wherein the non-linear filters include a heat filter and a shock filter, the heat filter applied to the digital image followed by application of the shock filter to the digital image.

12. The method of Claim 11, wherein the heat filter is defined by a partial differential equation of an inputted image pixel intensity u expressed in an equation defined as

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2},$$

where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u along the x-axis, and $\frac{\partial^2 u}{\partial y^2}$ is the second partial derivative of u along the y-axis.

13. The method of Claim 11, wherein the shock filter is a partial differential equation of an imputed image pixel intensity u expressed in an equation defined as

$$\frac{\partial u}{\partial t} = -sign(\frac{\partial^2 u}{dx^2})\left|\frac{\partial u}{dx}\right|,$$

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where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u, $\left|\frac{\partial u}{dx}\right|$ is the absolute value of the first derivative of u along the x-axis.

14. The method of Claim 9, wherein the optimum path algorithm includes a total cost function $C(p)$ weighted between an edge distance cost function, a path direction cost function, and a previous contour distance cost function from the equation

$$C(p) = \alpha C_e(p) + \beta C_d(p) + \gamma C_c(p),$$

where $C_e(p)$ is the edge distance cost function, $C_d(p)$ is the path direction cost function, $C_c(p)$ is the previous contour distance cost function, and $\alpha, \beta, and \gamma$ are numerical values.

15. The method of Claim 14, wherein the edge distance function $C_e(p)$ is defined from the equation

$$C_e(p) = \sum_{i=p1}^{p2} \left(\frac{1}{\mu + \|\nabla I_i\|}\right),$$

where I_i is the pixel intensity, $\|\nabla I_i\|$ is the gradient magnitude the pixel at location i, and μ is a constant value.

16. The method of Claim 14, wherein the path direction cost function $C_d(p)$ is defined from the equation

$$C_d(p) = \sum_{i=p1}^{p2} (I_i^{in} - I_i^{out}),$$

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where I_i^{in} is the image intensity of the inside and dark pixel and I_i^{out} is the image intensities the outside and bright pixel along a path bisecting the I_i^{in} and I_i^{out} pixels and connecting pixels points i and i_{-1} adjacent to each side of the I_i^{in} pixel.

17. The method of Claim 14, wherein the previous contour function $C_c(p)$ is defined by the equation

$$C_c(p) = \sum_{i=p1}^{p2} D_i^P,$$

where P is the previous contour and D_i^P is the distance of point i from the closest point on the previous contour.

18. A method to determine volume of a structure in digital images acquired from electromagnetic and non-electromagnetic sources, the method comprising:

positioning a transceiver exterior to a patient such that at least a portion of the structure is within a field of view of the transceiver, the transceiver configured to send electromagnetic radiation and to receive echoes of the electromagnetic radiation;

sending the radiation from the transceiver to the structure;

receiving echoes of the radiation reflected from the structure to the transceiver;

associating the received echoes to form a plurality of 2D scanplanes so that they form an array;

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enhancing the images of the structure in each plane of the array using non-linear filters; and

determining the structure volume spanning between and through each plane in the array.

19. The method of Claim 18, wherein plurality of 2D scanplanes are assembled into a plurality of arrays including a rotational array, a translational array, or a wedge array.

20. The method of Claim 18, wherein the non-linear filters include a heat filter and a shock filter, the heat filter applied to the digital images followed by application of the shock filter to the digital images.

21. The method of Claim 20, wherein the heat filter is defined by a partial differential equation of an inputted image pixel intensity u expressed in an equation defined as

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2},$$

where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u along the x-axis, and $\frac{\partial^2 u}{\partial y^2}$ is the second partial derivative of u along the y-axis.

22. The method of Claim 20, wherein the shock filter is a partial differential equation of an imputed image pixel intensity u expressed in an equation defined as

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$$\frac{\partial u}{\partial t} = -sign(\frac{\partial^2 u}{dx^2})\left|\frac{\partial u}{dx}\right|,$$

where u is the image being processed, $\frac{\partial^2 u}{\partial x^2}$ is the second partial derivative of u, $\left|\frac{\partial u}{dx}\right|$ is the absolute value of the first derivative of u along the x-axis.

23. The method of Claim 18, wherein the plurality algorithms includes a spatial gradient algorithm, a previous contour algorithm, and an optimal path algorithm that combines the spatial gradient and the previous contour algorithms to produce the homogeneous regions.

24. The method of Claim 23, wherein the optimum path algorithm includes a total cost function $C(p)$ weighted between an edge distance cost function, a path direction cost function, and a previous contour distance cost function from the equation

$$C(p) = \alpha C_e(p) + \beta C_d(p) + \gamma C_c(p),$$

where $C_e(p)$ is the edge distance cost function, $C_d(p)$ is the path direction cost function, $C_c(p)$ is the previous contour distance cost function, and $\alpha, \beta, and \gamma$ are numerical values.

25. The method of Claim 24, wherein the edge distance function $C_e(p)$ is defined from the equation

$$C_e(p) = \sum_{i=p1}^{p2}(\frac{1}{\mu + \|\nabla I_i\|}),$$

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where I_i is the pixel intensity, $\|\nabla I_i\|$ is the gradient magnitude the pixel at location i, and μ isconstant value.

26. The method of Claim 24, wherein the path direction cost function $C_d(p)$ is defined from the equation

$$C_d(p) = \sum_{i=p1}^{p2} (I_i^{in} - I_i^{out}),$$

where I_i^{in} is the image intensity of the inside and dark pixel and I_i^{out} is the image intensities the outside and bright pixel along a path bisecting the I_i^{in} and I_i^{out} pixels and connecting pixels points i and i_{-1} adjacent to each side of the I_i^{in} pixel.

27. The method of Claim 24, wherein the previous contour function $C_c(p)$ is defined by the equation

$$C_c(p) = \sum_{i=p1}^{p2} D_i^P,$$

where P is the previous contour and D_i^P is the distance of point i from the closest point on the previous contour.

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